MEC-1000
Portable
Patient Monitor

Service Manual

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SHENZHEN MINDRAY BIO-MEDICAL ELECTRONICS CO., LTD. 2003

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Preface

This service manual gives a detailed description of the MEC-1000 Patient Monitor, including circuit descriptions, test procedures and a spare part listing. This manual is intended as a guide for technically qualified personnel during repair, testing or calibration procedures.

Following symbols indicates some important facts that you have to pay special attention to:

⚠ **Warning** ⚠ Points to be noted to avoid injury to the patient and the operator.

⚠ **Caution** ⚠ Points to be noted to avoid damage to the equipment.

⚠**Note** ⚠ Points to be noted.

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Chapter 1 General

MEC-1000 is a flexible, portable patient monitor. MEC-1000 can monitor physiological signals including ECG, RESP. Rate, NIBP, SpO_2, and TEMP. MEC-1000 can convert these physiological signals into digital signals, which can be further processed and used to judge whether to trigger alarm. The user can control the operation of MEC-1000 via using the buttons on the front panel. MEC-1000 can be connected to the central monitoring system via the Mindray network so as to form a network monitoring system.

MEC-1000 uses ECG electrodes, SpO_2 finger sensor, blood pressure cuff and temperature probe to measure the physiological signals including ECG, NIBP, SpO_2, TEMP and RESP Rate. In the process of measurement no energy or substances are extracted from and/or delivered to the patient with the exception that sine wave signals are delivered to the patient during measuring RESP Rate. MEC-1000 converts the acquired physiological signals into digital signals, waveform and numerical values and displays all information on the screen. The user can also control the operation of the monitor via using the buttons on the front panel. The user can set alarm limits for each parameter. In this way once finding a physiological parameter exceed the pre-set alarm limits, MEC-1000 will activate its visual and audio alarm (the numerical display flashes or lights on) in order to raise the user's attention.

1.1 General

During treatment, it is highly important to continuously monitor the vital physiological signs of the patient to transmit the important information. Therefore patient monitor has always been occupying a very important position in the filed of medical devices. The continuous improvement of technologies not only helps us transmit the vital physiological signs to the medical personnel but also simplifies the measurement and as a result raise the monitoring efficiency. For inpatients, we need to measure those vital cardiac and pulmonary signs such as ECG, SpO_2, blood pressure and TEMP, etc. In recent years, the technological improvement pertaining to measurement and information transmission has led to more comprehensive performance and stable quality of the patient monitoring products. In the past, the dominant products manufactured by medical device manufacturers are mainly those for single parameter measurement. Nowadays however multi-parameter patient monitors are more widely and commonly used.

1.2 Intended Use

MEC-1000 patient monitor can measure physiological signals including ECG, RESP., NIBP, SpO_2 and TEMP. It can convert these physiological signals into digital signals and further display them on the screen. The alarm limits can be user-defined. Once finding a parameter reach or exceed its pre-set alarm limits, MEC-1000 can automatically activate the corresponding alarm. In addition, the user can operate the monitor by using the buttons on the front panel. In addition to outpatient department, monitors are generally used in some clinical areas such as ICU, CCU, operation room and emergency room because the monitor can provide many other physiological parameters of the patient to medical personnel. Only

the qualified medical personnel shall use MEC-1000 patient monitor.

1.3 Environmental Conditions

1.3.1 Temperature

Operating	0 - 40 °C
Transportation and Storage	-20 - 60 °C

1.3.2 Humidity

Working	15% ~ 95%
Transport and Storage	10% ~ 95%（noncondensing）

1.3.3 Altitude

Operating	-500 to 4,600 meters
Transportation and Storage	-500 to 13,100 meters

1.3.4 Electrical specification

100-250 VAC, 50/60Hz，max. input power consumption 110VA

Chapter 2 Principle

2.1 MEC-1000 Principle

MEC-1000 portable patient monitor has been designed to measure physiological parameters including ECG, RESP, TEMP, NIBP and SPO2, etc. Figure2-1 shows the structure of the whole monitor as well as the connection relationships between different parts. The board in the center of the figure is the core part of the monitor, i.e., integrated board for main control and parameter measurement, which, though being a single board, could realize the measurements of five said parameters; accordingly uniform AD conversion and digital processing system is used.

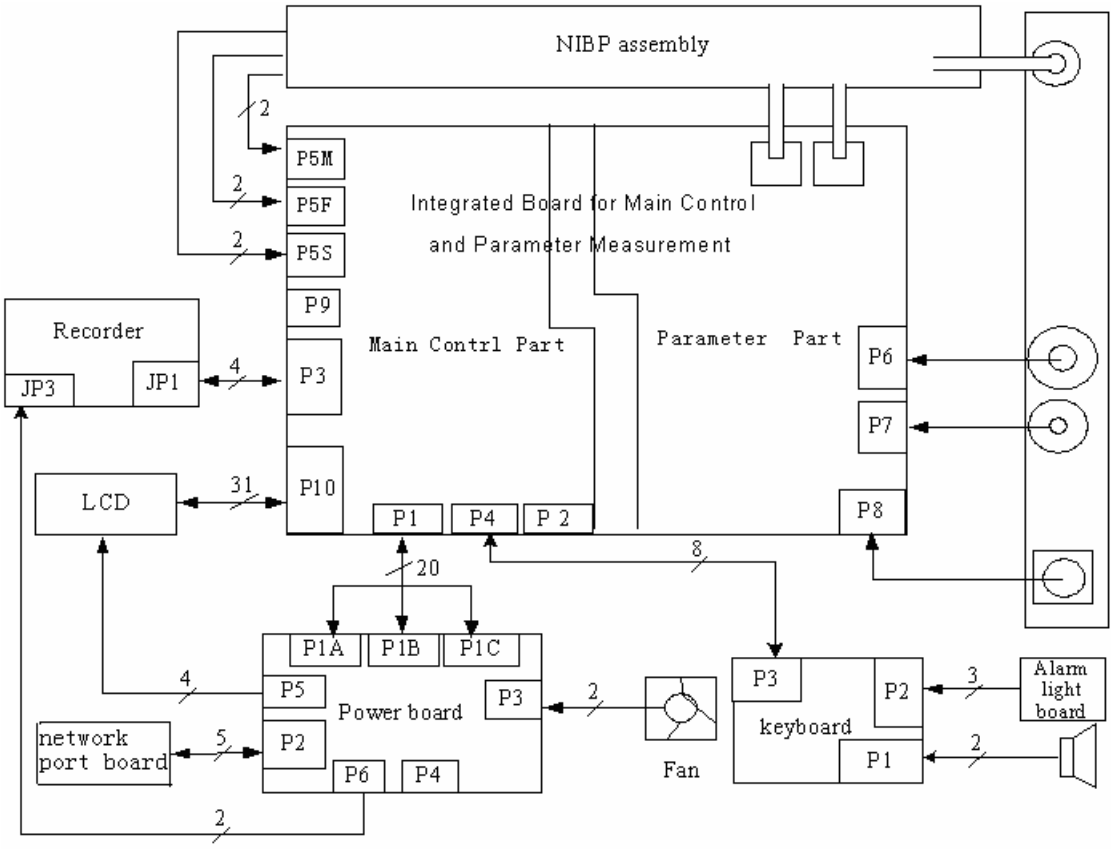


Figure 2- 1 MEC-1000 structure and part relationship

In terms of its functionality, MEC-1000 is made up of following parts:

1) Parameter measurement part
2) Main control part
3) Man-machine interface
4) Power supply
5) Other auxiliary part

Below is the detailed introduction to each part.

2.1.1 Parameter measurement part

Parameter measurement and monitoring are primary functions of the monitor. The parameter measurement part of the monitor consists of measurement probe (excluded in figure 2-1), parameter input socket assembly, NIBP assembly and the parameter part of the main control board. Its function is to convert the physiological signals into electronic signals, process them and execute calculations according to pre-set programs or the commands from the main control part, and then to send data of values, waveforms and alarms back to the main control part. The data will then be displayed via man-machine interface.

2.1.2 Main control part

The main control part of the integrated board is to drive man-machine interface, manage parameter measurement and provide other specific functions to the user such as configuration storage, waveform and data recall, etc.

2.1.3 Man-machine interface

The man-machine interfaces are LCD display, recorder, speaker, indicator, keys and knob.

The LCD display is the most primary output interface, displaying real-time or history data and waveforms, various patient information and alarm prompts on the screen for the user's observation.

Recorder is an auxiliary device to the display, which could print out various user-selected data for use and preservation.

Speaker gives audio alarm.

Indicator provides additional information about power supply, battery and alarm.

Keys and knob are user input interface of the system, by using which the user could input information and instructions into the monitor.

2.1.4 Power supply

Power supply is an important part of the system, consisting of power board, backlight board, battery and fan.

The main power board converts the AC mains input into 5V and 12V DC to energize other parts of the system. Similarly LCD display requires particular supply, for which case a backlight board is supplied. The battery could maintain the formal function of the system for a short period when AC mains is disconnected. A small fan requiring DC input is used to realize superior ventilation.

2.1.5 Other auxiliary part

Network port is available on MEC-1000, which allows the service engineer to upgrade the system software without necessarily opening the enclosure of the monitor.And can be

connected to the Minday Center manage System.

2.2 Main Control Part

2.2.1 Functions of main control part

As the core part of the whole system, it finishes the following functions:

1) control, management and scheduling of parameter measurement part, recorder and keyboard;
2) display drive of TFT screen, STN screen and CRT screen;
3) 3-way expansion serial port realized by FPGA;
4) alarm given for system fault;
5) storage of RTC, hardware WatchDog and relevant parameters

2.2.2 Schematic Diagram

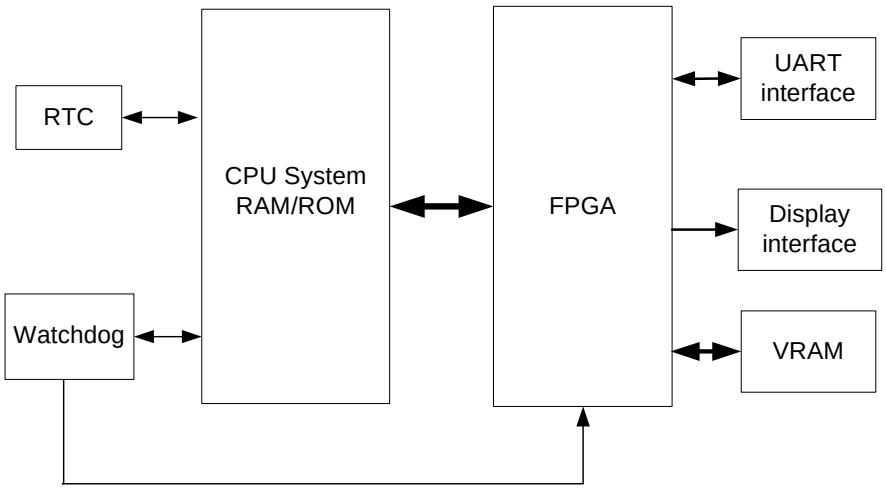


Figure 2-2 Schematic Diagram of Main Control Part

2.2.3 Introduction to Principle

The main control Module, being the center part of the system, has serial ports to various modules, TFT display interface, CRT display interface. The BDM interface is reserved on the board for debugging or downloading software.

2.2.3.1 CPU System

CPU is the core element on the main control Module. It connects peripheral modules through BUS and I/Os in order to finish data communication, data processing and logic control, etc.

2.2.3.2 RTC

RTC (real-time clock) provides time (hour, minute, second) and date (year, month, day) information. RTC information can be changed by CPU.

2.2.3.3 FPGA and VRAM

VRAM is used to save display data. CPU sends display data to VRAM via FPGA. The data in VRAM is a map of the real display device.

FPGA has various extended serial ports, which communicate with external Parameter Parts. CPU writes acquired data to FPGA, and FPGA sends it to external Parameter Parts.

2.2.3.4 Watchdog

Upon power-up, Watchdog supplies Reset signals to CPU, FPGA and Ethernet Controller.

Provide functions of Waterdog Timer Output and voltage supervise.

2.2.3.5 Ethernet Controller

Ethernet Controller complies with IEEE802.3 / IEEE802.3u LAN standard, supports 10Mbps and 100Mbps data rates, and realizes the data communication between CPU and Ethernet.

2.3 Parameter Part

2.3.1 Introduction to Principle

The parameter part collects, amplifies and filters the signals of the said five physiological parameters, executes A/D over the signals and processes the result signals. Figure 2-3 shows the structure of this part.

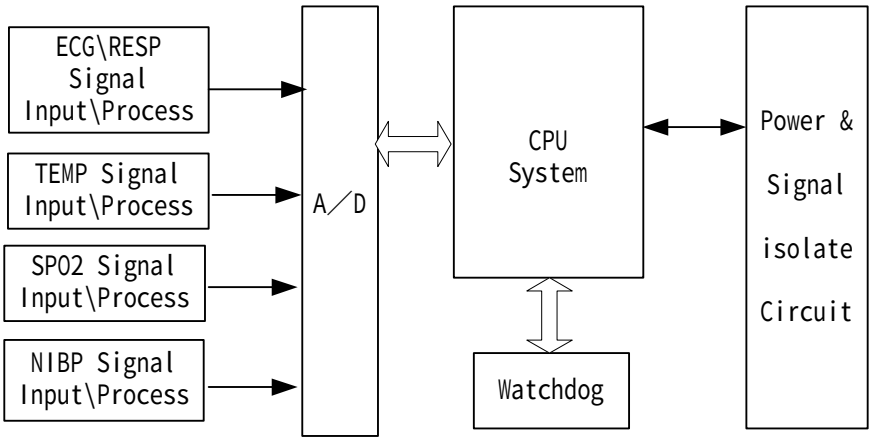


Figure 2-3 Schematic Diagram of Parameter Part

A/D and CPU in parameter part are shared for processing signals of the said five parameters, i.e., ECG, RESP, TEMP, NIBP and SPO2.

A/D

Convert analog signals output from parameter circuit into digital signals, and send them

into CPU part to receive further processing.

CPU System

Realize logic control over all parameter parts and A/D part.
Process data of each parameter;
Communicate with main board.

Power & Signal isolate Circuit

Realize isolation from external circuit in order to ensure human safety;
Provide power supplies for circuits;
Realize isolating communication between CPU System and main board.

Watchdog

Upon power-on, supply Reset signal to CPU;
Provide functions of Watchdog Timer Output and voltage detection.

2.3.2 ECG/RESP Module

2.3.2.1 General

This module is designed to measure two parameters including ECG, RESP.

2.3.2.2 Schematic Diagram

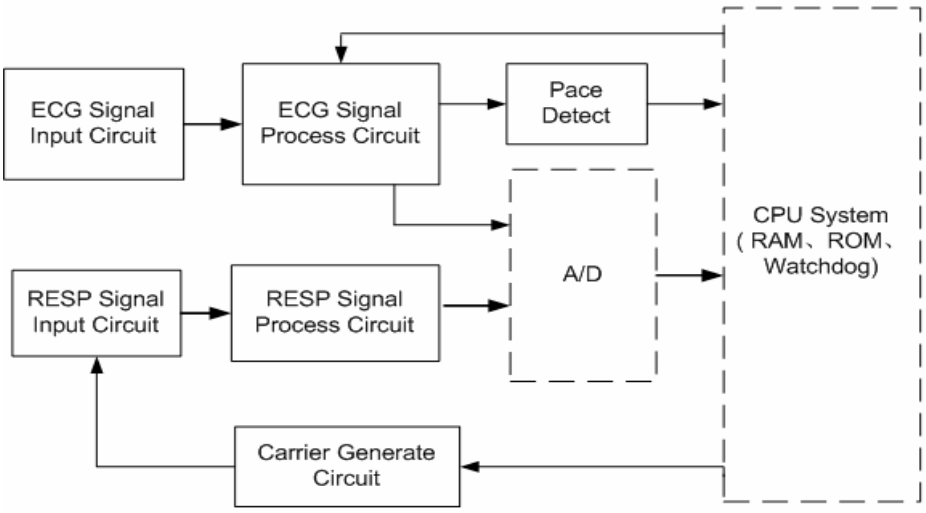


Figure 2-4 Schematic Diagram of ECG/RESP Module

2.3.2.3 Introduction to Principle

This module uses ECG cables to collect ECG, RESP signals, process them and transmit them to the main control part through serial port.

ECG Signal Input Circuit

Input protection and filter circuit: receives ECG signals from cables, removes high-frequency

interference and prevents the circuit from being damaged by high voltage generated in defibrillation and ESD.
Right leg drive circuit: picks up 50/60Hz common-mode signals in lead wire and feeds them back to patient body; suppresses the common-mode interference in lead wire for the sake of better detecting ECG signals.
Lead Off detection circuit: detects if any ECG lead falls off and transmits relevant message to CPU.

ECG Signal Process Circuit

Differential Amplification circuit: first-order amplifies ECG signals and suppresses common-mode interference at the same time.
Low-pass filter circuit: removes high-frequency interference outside frequency band of ECG signals.
PACE signals are ECG pacing signals, which greatly affect ECG detecting performance. Therefore PACE suppression circuit is designed to suppress PACE signals in order to better detect ECG signals.
Master AMP/Filter circuit: amplifies and filters ECG signals again and transmits them furthermore into A/D converter.

Pace Detect

Pick PACE signals out of ECG signals and transmit them to CPU.

Carrier Generate Circuit

RESP measurement is based on Impedance method. Respiration causes the changes of thoracic impedances, which feature is taken advantage to modulate the amplitude of high frequency carrier. The modulated signals are then sent into the measuring circuit. This circuit is designed to generate high frequency carrier

RESP Signal Input Circuit

Couples the RESP signals into the detection circuit.

RESP Signal Process Circuit

Preamplifier circuit: amplifies and filters RESP signals;
Detection circuit: picks out the RESP wave modulated in excitation signals;
Level translation circuit: removes DC components in RESP signals;
Master AMP/Filter circuit: amplifies and filters RESP signals again and transmits them furthermore into A/D converter.

A/D and CPU System (Description in frame of dashed lines)

Refer to the 2.3.1

2.3.3 TEMP Module

2.3.3.1 General

This module uses sensors to collect TEMP signals, process them and transmit them to the main control part through serial port.

2.3.3.2 Schematic Diagram

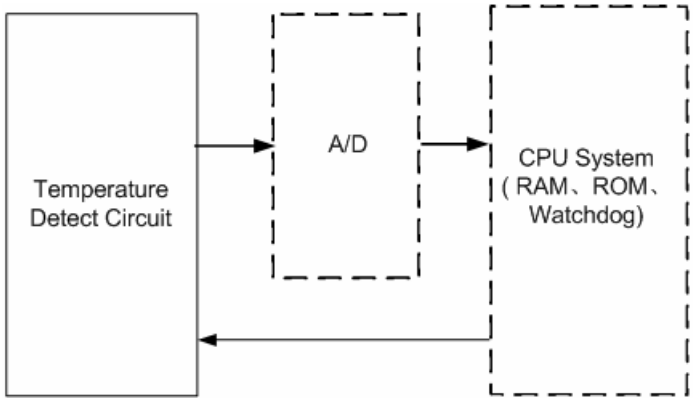


Figure 2-5 Schematic Diagram of TEMP Module

2.3.3.3 Introduction to Principle

Measure temperature of body surface or endocavity by taking advantage of the characteristics of the thermal-sensitive resistor whose impedance varies with temperature of human body.

Temperature Detect Circuit

Receive the signal transmitted from TEMP sensor, amplify the signal and send it into A/D converter.

A/D and CPU System (Description in frame of dashed lines)

Refer to the 2.3.1

2.3.4 SPO2 Module

2.3.4.1 General

This module is designed to measure SPO2.

2.3.4.2 Schematic Diagram

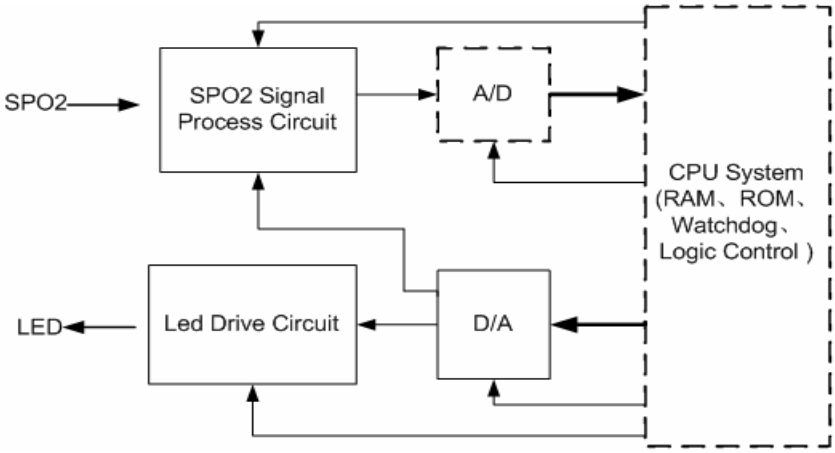


Figure 2-6 Schematic Diagram of SPO2 Module

2.3.4.3 Introduction to Principle

Sensor is used to collect the signals of red and infrared lights having penetrated human finger or toe. Relevant unit is designed to process the acquired signals and accordingly give the result. Driving current of LED and gain of AMP circuit are controlled to fit different patients.Led Drive Circuit

Provide driving current to LED. The driving current is adjustable.

SPO2 Signal Process Circuit

Preamplifier circuit converts photocurrent signals into voltage signals and additionally first-order amplifies them;
Gain adjustment and amplification circuit amplifies the signals and adjusts their gain;
Bias circuit adjusts the dynamic range of the signals and then sends them into A/D converter.

D/A

Convert digital signals output from CPU into analog signals, supply control signals to Led Drive Circuit and SPO2 Signal Process Circuit.

A/D and CPU System (Description in frame of dashed lines)

Refer to the 2.3.1

2.3.5 NIBP Module

2.3.5.1 General

This module is designed to measure NIBP.

2.3.5.2 Schematic Diagram

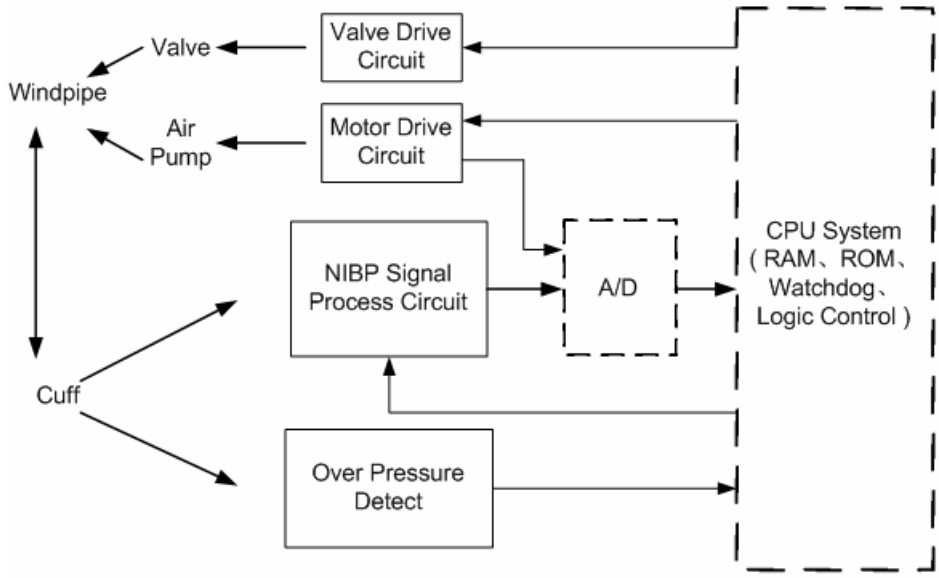


Figure 2-7 Schematic Diagram of NIBP Module

2.3.5.3 Introduction to Principle

Oscillometric method is adopted to measure NIBP. Inflate the cuff wrapped around the upper arm until the pressure makes the blood in the artery of the upper arm stops flowing. Then deflate the cuff according to the requirement of the algorithm. Blood flow in the artery resumes as the cuff pressure decrease, which will cause corresponding pulsation in the cuff. The pressure sensor connecting the inflating hose of the cuff will accordingly generate pulsating signals. The NIBP module can process these signals and give measuring result.

Valve Drive Circuit

Control OPEN/CLOSE of the valve. This circuit, together with Motor Drive Circuit, finishes the action of inflating and deflating cuff.

Motor Drive Circuit

Control the action of air pump. This circuit, together with Valve Drive Circuit, finishes the action of inflating and deflating cuff. Moreover, it supplies motor status signal to A/D converter for detection.

NIBP Signal Process Circuit

NIBP signals are differential signals. Differential Amplify circuit amplifies the differential signals and converts them into single ended signals and at the same time sends the signal of one way to A/D converter and the signal of the other way to the Blocking and AMP circuit.
Blocking and AMP circuit removes the DC components in the signals, amplifies the signals and then sends them into A/D converter.

Over Pressure Detect

Detect NIBP pressure signals. Once the pressure exceeds the protection limit, it sends the message to CPU System, which will accordingly control the Valve Drive Circuit to open the

valve to deflate the cuff so as to reduce the pressure.

A/D and CPU System (Description in frame of dashed lines)

Refer to the 2.3.1

2.4 Power Board

2.4.1 General

This module provides DC supplies to other boards.

2.4.2 Schematic Diagram

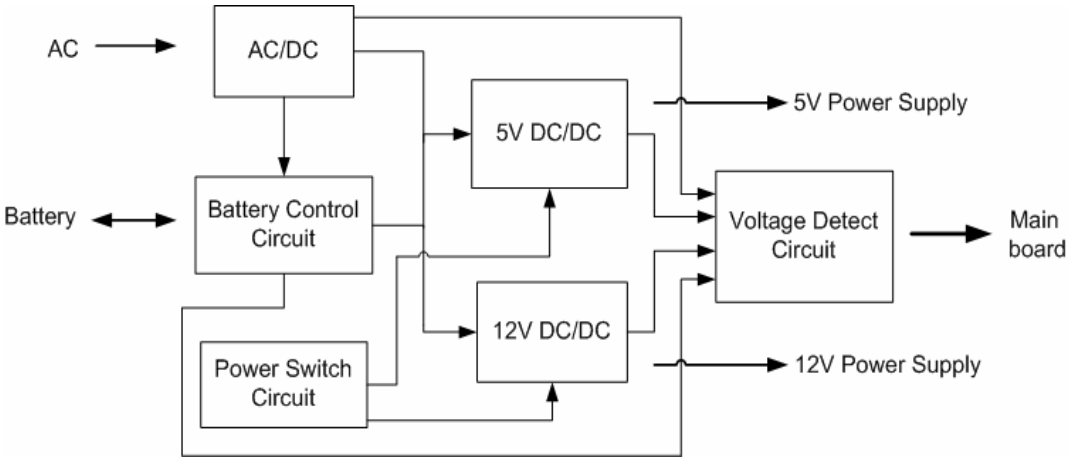


Figure 2-8 Schematic Diagram of Power Board

2.4.3 Introduction to Principle

This module converts 220V AC mains or battery power into 5V and 12V DC supplies to power other boards. If AC mains and battery coexist, the former take the priority to power the system and charge the latter at the same time.

AC/DC

Convert high-voltage AC supply into low-voltage DC supplies to power subsequent circuits and charge the battery.

Battery Control Circuit

If AC mains and battery coexist, this circuit controls the output from AC/DC part to charge the battery. If AC mains is disconnected, this circuit controls the battery to power the subsequent circuits.

5V DC/DC

Convert the DC supply from the previous circuit into stable 5V DC supply to power other boards.

12V DC/DC

Convert the DC supply from the previous circuit into stable 12V DC supply to power other boards.

Power Switch Circuit

Control the working status of 5V DC/DC and 12V DC/DC in order to control ON/OFF action of the patient monitor.

Voltage Detect Circuit

Detect the output voltages of various parts of the circuits; convert the analog signals into digital signals and send them into main board for further processing.

2.4.4 Testing key points

After connecting AC mains, the DC voltage over C12 is about 1.3 ~ 1.4 time of AC input voltage; voltage over C15 is 17.6V. Voltage over C24 is 13.8V when battery is disconnected. Voltage over C47 is 5V applied to power U7, U8 and U9. Voltages of pin8 of U1, pin8 of U10 and pin11 of U11 to the ground are all 5V. Voltage of pin2 of U10 to the ground is 2.5V. On the oscillograph, we can observe that voltage waves of pin4 of U11 and pin4 of U10 to the ground are standard toothed waves of 120kHz oscillating frequency. Voltage waves of pin1 of Q1 and pin1 of Q5 when output is connected with rated load are square waves of about 120kHz frequency. Voltage wave of D16 is a square one of about 280kHz frequency.

2.5 Keyboard

2.5.1 General

This module acts as the man-machine interface.

2.5.2 Schematic Diagram

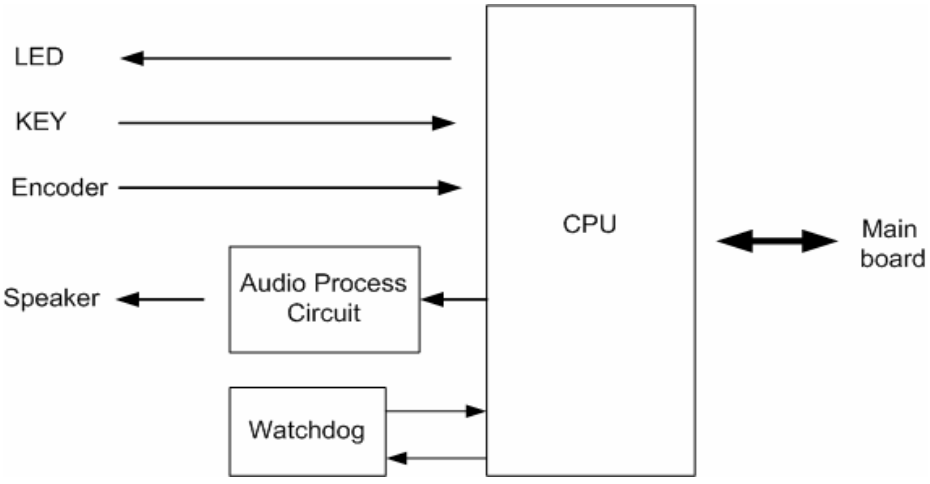


Figure 2-9 Schematic Diagram of Keyboard

2.5.3 Introduction to Principle

This module detects key and encoder input signals, converts them into codes and sends to the main board. The main board sends command to the keyboard and the latter accordingly control indicator and audio process circuit to act so as to realize audio and visual alarm.

CPU

Detect key and encoder input signals;
Control LED status;
Control Audio Process Circuit;
Regularly zero Watchdog Timer;
Communicate with main board.

Audio Process Circuit

Generate audio signals to drive the speaker to give sound.

Watchdog

Upon power-up, supply Reset signal to CPU;
Provide functions of Waterdog Timer Output and voltage detection.

2.6 Recorder Module

2.6.1 General

This module is designed to drive line thermal printer.

2.6.2 Schematic Diagram

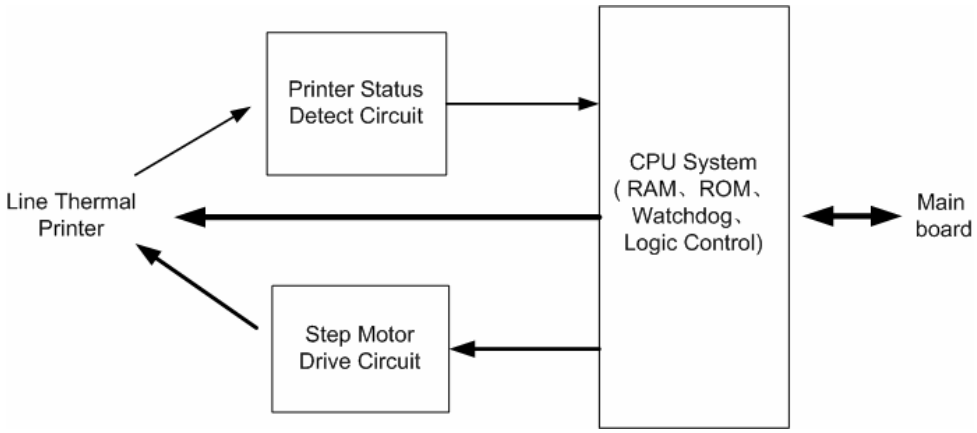


Figure 2-10 Schematic Diagram of Recorder Module

2.6.3 Introduction to Principle

This module receives printing data from the main board. At the same time of converting the data into dot matrix data and sending them to the printer, it also drives the printer to start printing action.

Step Motor Drive Circuit

A step motor is used in the printer to feed paper. This circuit is designed to drive the step motor to act.

Printer Status Detect Circuit

Detect the status of the printer, including the position of paper platen, if there is paper, and temperature of thermal head and send the information to CPU System.

CPU System

Process printing data;
Control printer and step motor;
Collect printer status information and realize corresponding control;
Communicate with main board.

Chapter 3 Product Specification

3.1 Classification

Anti-electroshock type	Class I equipment with internal power supply
EMC type	Class A
Anti-electroshock degree	ECG (RESP), SpO_2, NIBP, TEMP CF
Harmful liquid proof degree	Ordinary equipment (sealed equipment without liquid proof)
Working system	Continuous running equipment

3.2 Specifications

3.2.1 Size and Weight

Size	318 x 152 x 264 mm
Weight	4 kg

3.2.2 Environment

Temperature		
	Working	0 ~ 40 °C
	Transport and Storage	-20 ~ 60 °C
Humidity		
	Working	15% ~ 95%
	Transport and Storage	10% ~ 95%（noncondensing）
Altitude		
	Working	-500 ~ 4,600m
	Transport and Storage	-500 ~ 13,100m
Power Supply		100 ~ 250 VAC, 50/60 Hz, Pmax=110 VA FUSE T 1.6A

3.2.3 Battery

Rechargeable Lead-Acid	2.3Ah 12V
Operating time under the normal condition	100 minutes (2 batteries)
Operating time after the first alarm of low battery	5 ~ 15 minutes

Maximum charging time of single battery is 4 hours. Maximum charging time of two batteries is 8 hours.

3.2.4 Display

Screen	10.4” Color TFT, 800 x 600 Resolution
Messages	
	4 Waveforms Maximum
	1 Alarm LED (Yellow/Red)
	1 Power LED (Green)
	1 Charge LED (Green)
	3 Sound Modes corresponding to Alarm Modes

3.2.5 Signal Interface

Do not have this function

3.2.6 Recorder

Record Width	48 mm
Paper Speed	25/50 mm/S
Trace	2
Recording types:	
	Continuous real-time recording
	8 second real-time recording
	Auto 8 second recording
	Parameter alarm recording
	Waveform freeze recording
	Trend graph/table recording
	ARR events review recording
	Alarm event review recording
	NIBP review recording
	Drug Calculation and titration table recording
	Monitor information recording

3.2.7 Recall

Trend Recall

Short	1 hour, 1 or 5 second Resolution
Long	72 hours, 1 minute Resolution

Alarm Event Recall

60 alarm events of all parameters and 8/16/32seconds of corresponding waveform.

NIBP Measurement Recall

400 NIBP measurement data

Power-off Storage

72 hours of trend data, 400 NIBP measurement data, 60 alarm events and 60 Arr. Events

3.2.8 ECG

Lead Mode	3 Leads (R, L, F or RA, LA, LL)	
Lead selection	I, II, III	
Waveform	1 channel	
Gain	×0.25mm/mV, ×0.5mm/mV, ×1mm/mV, ×2mm/mV, AUTO	
HR and Alarm		
Range		
Adult	15 ~ 300 bpm	
Neo/Ped	15 ~ 350 bpm	
Accuracy	±1% or ±1bpm, use the greater	
Resolution	1 bpm	
Sensitivity	> 200uV (Vp-p)	
Differential Input Impedance	> 5 MΩ	
CMRR		
	Monitor	> 105 dB
	Surgery	> 105 dB
	Diagnostic	> 90 dB
Electrode offset potential	±300mV	
Leakage Current	< 10 uA	
Defibrillation Recovery Time	< 3s After Defibrillation (in Monitor or Surgery mode)	
ECG Signal Range	± 5mV (Vp-p)	
Frequency Response (Bandwidth)		
Surgery	1 ~ 15 Hz	
Monitor	0.5 ~ 35 Hz	
Diagnostic	0.05 ~ 100 Hz	
Calibration Signal	1mV (Vp-p), Accuracy: ±5%	
ST Segment Monitoring Range		
Measure and Alarm	-2.0 ~ +2.0 mV	
ARR Detecting		
Type	ASYSTOLE, VFIB/VTAC, COUPLET, BIGEMINY, TRIGEMINY, R ON T, VT>2, PVC, TACHY, BRADY, MISSED BEATS, PNP, PNC	
Alarm	Available	
Review	Available	

3.2.9 RESPARATION (RESP)

Method	Impedance between R-F (RA-LL)
Measuring Impedance Range:	0.3 ~ 5.0Ω

Base line Impedance Range: 200 ~ 1500Ω
Bandwidth 0.3 ~ 2.5 Hz
Resp. Rate
Measuring and Alarm Range
Adult 0 ~ 120 BrPM
Neo/Ped 0 ~ 150 BrPM
Resolution 1 BrPM
Accuracy 0 ~ 6 BrPM: Unspecified
7 ~ 150 BrPM: ±2 BrPM or ±2% whichever is greater
Apean Alarm 10 ~ 40 s

3.2.10 NIBP

Method Oscillometric
Mode MANUAL, AUTO, CONTINUOUS
Measuring Interval in AUTO Mode
1, 2, 3, 4, 5, 10, 15, 30, 60, 90, 120, 180, 240,480Min
Measuring Period in CONTINUOUS Mode
5 Min
Measuring and alarm range
Adult Mode
SYS 40 ~ 270 mmHg
DIA 10 ~ 215 mmHg
MEAN 20 ~ 235 mmHg
Pediatric Mode
SYS 40 ~ 200 mmHg
DIA 10 ~ 150 mmHg
MEAN 20 ~ 165 mmHg
Neonatal Mode
SYS 40 ~ 135 mmHg
DIA 10 ~ 100 mmHg
MEAN 20 ~ 110 mmHg
Resolution
Pressure 1mmHg
Static pressure accuracy ± 3mmHg
Accuracy
Pressure
Maximum Mean error ±5mmHg
Maximum Standard deviation 8mmHg
Overpressure Protection
Adult Mode 297±3 mmHg
Pediatric Mode 240±3 mmHg
Neonatal Mode 147±3 mmHg

3.2.11 SpO_2

Measuring Range	0 ~ 100 %
Alarm Range	0 ~ 100 %
Resolution	1 %
Accuracy	
	70% ~ 100%: ±2 %
	0% ~ 69%: Unspecified
Actualization interval	about 1s
Alarm Delay	10s
Pulse Rate	
Measuring and Alarm Range	
	20 ~ 254bpm
Resolution	1bpm
Accuracy	± 3bpm
Alarm Delay	10s

3.2.12 TEMPERATURE (TEMP)

Channel	1
Measuring and Alarm Range	0 ~ 50 °C
Resolution	0.1°C
Accuracy	± 0.1 °C
Actualization interval	about 1 Sec.

Chaptr 4 Structure and Part List

4.1.1 MEC-1000 Explosive view

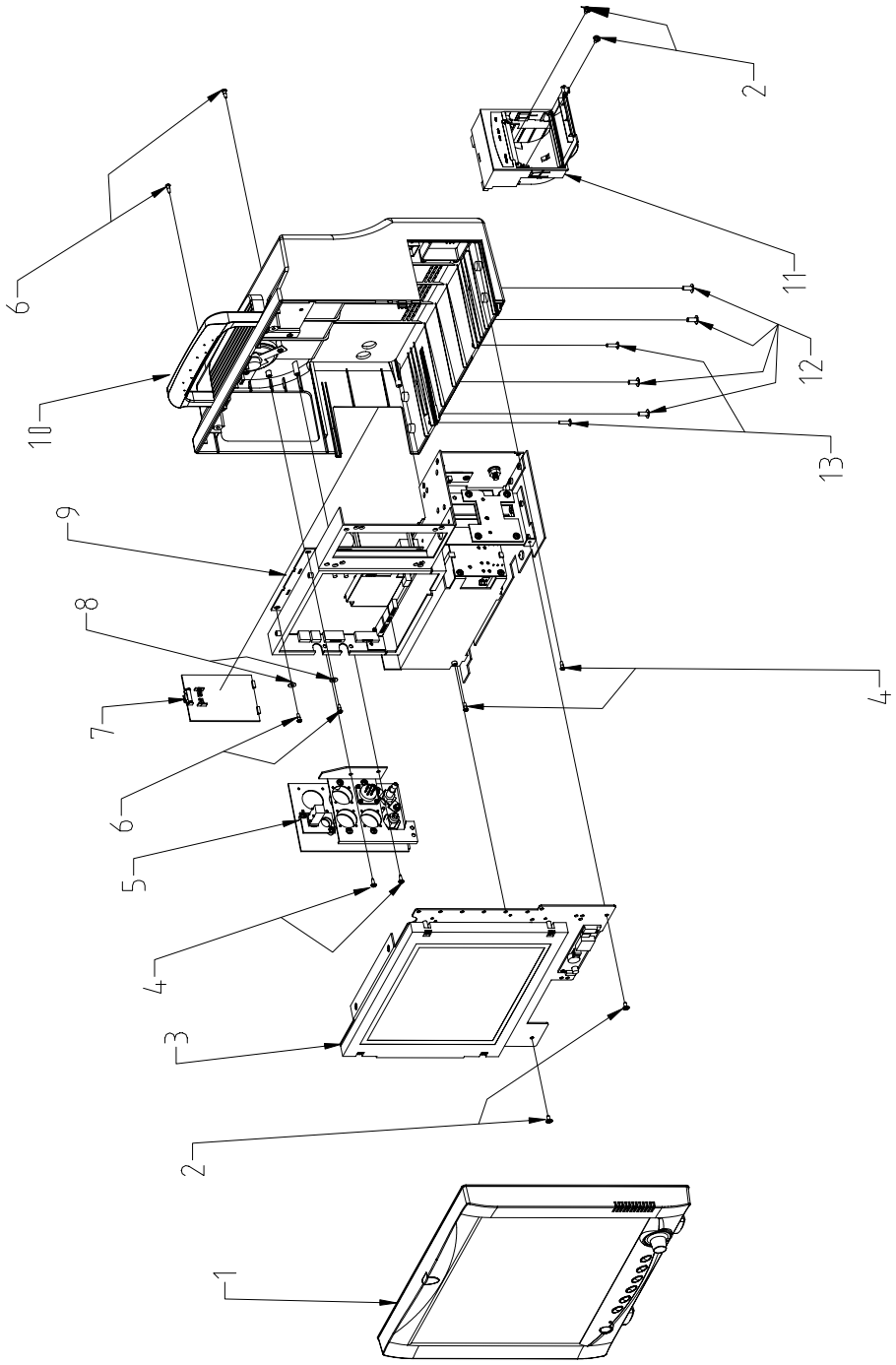


Figure 4-1 Graphics, exploded

1	M1K1-30-22368	Front panel assembly	1		
2	M04-004012---	Cross phoned screw with washer	4		

		M3x6			
3	9300-30-13793 or M1K1-30-22355	10.4' Au TFT screen Assembly or 10.4 ' TFT LG 800*600 screen Assembly	1		
4	M04-003105---	Screw GB845-85 M3x8	2		
5	9303-30-21801	6 Pin parameter socket panel	1		
6	M04-000305---	Screw GB845-85 M3x12	4		
7	9000-20-05185	Battery Door	1		
8	M04-000802---	Washer GB972-3	2		
9	9303-30-21804	Bracket Assembly	1		
10	M1K1-30-22305	Rear panel assembly	1		
11	TR6C-30-16657	TR6C-C recorder package	1		
12	M04-004014---	Cross phoned screw with washer M4x10	4		
13	M04-004017---	Cross phoned screw with washer M3x12	2		
SN	Standard Code	Name & SPEC.	QTY.	Material	Remarks

4.1.2 MEC-1000 TFT Screen Assembly

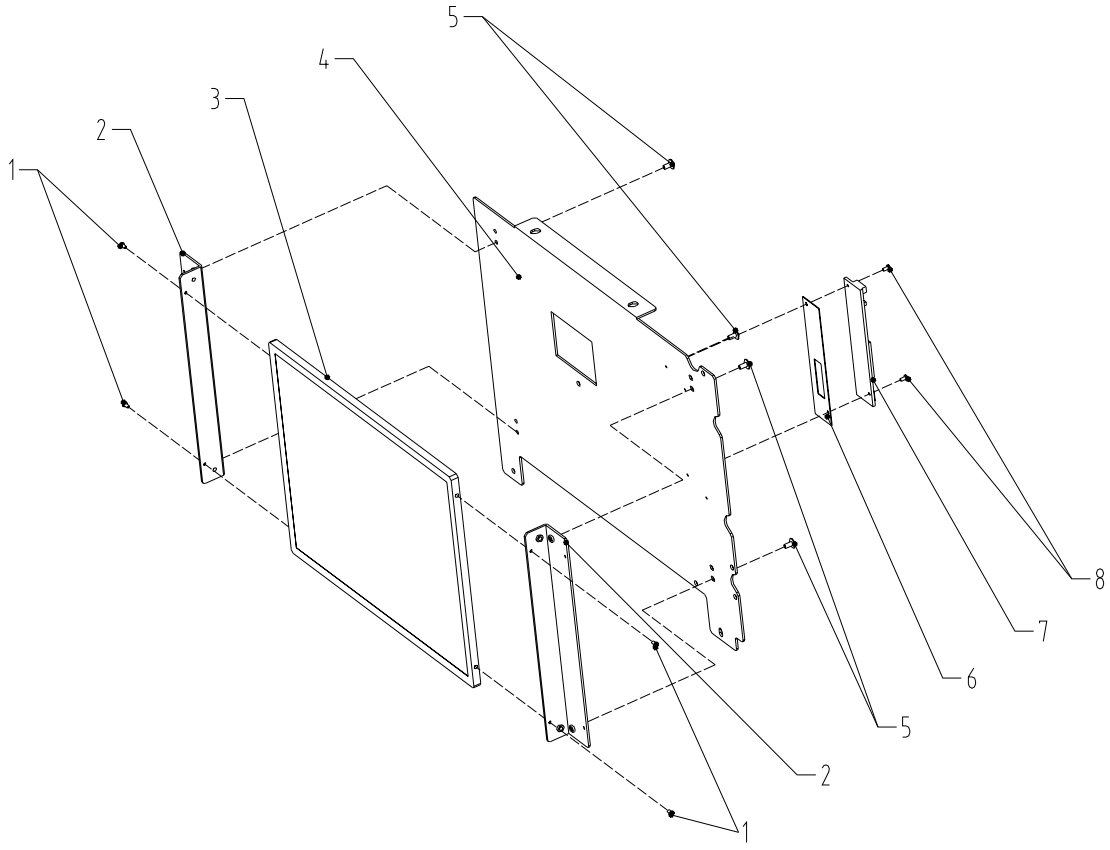


Figure 4-2-1 MEC-1000 LG TFT screen assembly

1	M04-051137---	Cross phoned screw GB 818-85 with washer M2x4	4		
2	9300-20-13911	TFT support bar(LP104S5"LG")	2		
3	0010-10-12362	10.4' LG TFT screen	1		
4	9300-20-13911	TFT support bar(LP104S5"LG")	1	LY12 T=1.5	
5	M04-004012---	Hexagon Nut M3x6	4		
6	9300-20-13901	Isolation panel	1		
7	0010-10-12096	INVERTOR"TAMURA"	1		
8	M04-002405---	Isolation Washer	2		
SN	Standard Code	Name & Specification	QTY.	Material	Remarks

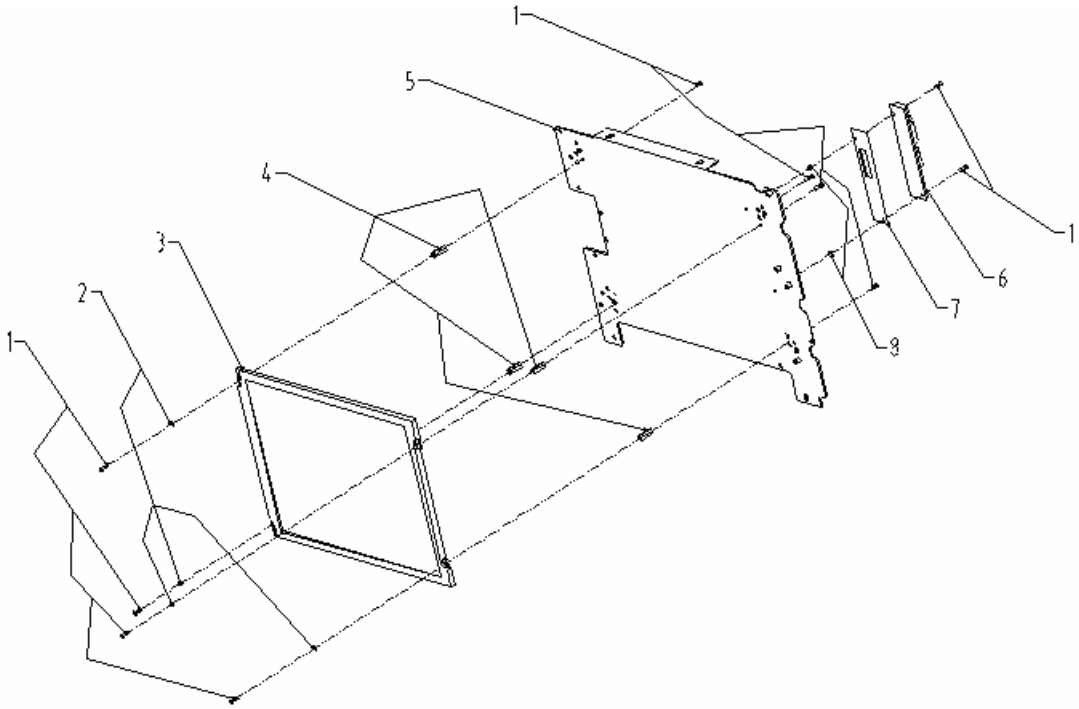


Figure 4-2-2 MEC-1000 Au TFT screen assembly

1	M04-000805---	Cross phoned screw with washer M2x8	10		
2	M04-000102---	Hexagon Nut M3x6	4		
3	0010-10-12357	10.4' AU TFT screen	1		
4	9300-20-13972	Pole M2 x14	4		

5	9300-20-13766	Support of TFT screen	1	LY12 T=1.5	
6	0010-10-12096	INVERTOR ”TAMURA”	1		
7	9300-20-13901	Isolation panel	1		
8	M90-000002-01	Isolation Washer	2		
SN	Standard Code	Name & Specification	QTY.	Material	Remarks

4.1.3 MEC-1000 Bracket Assembly

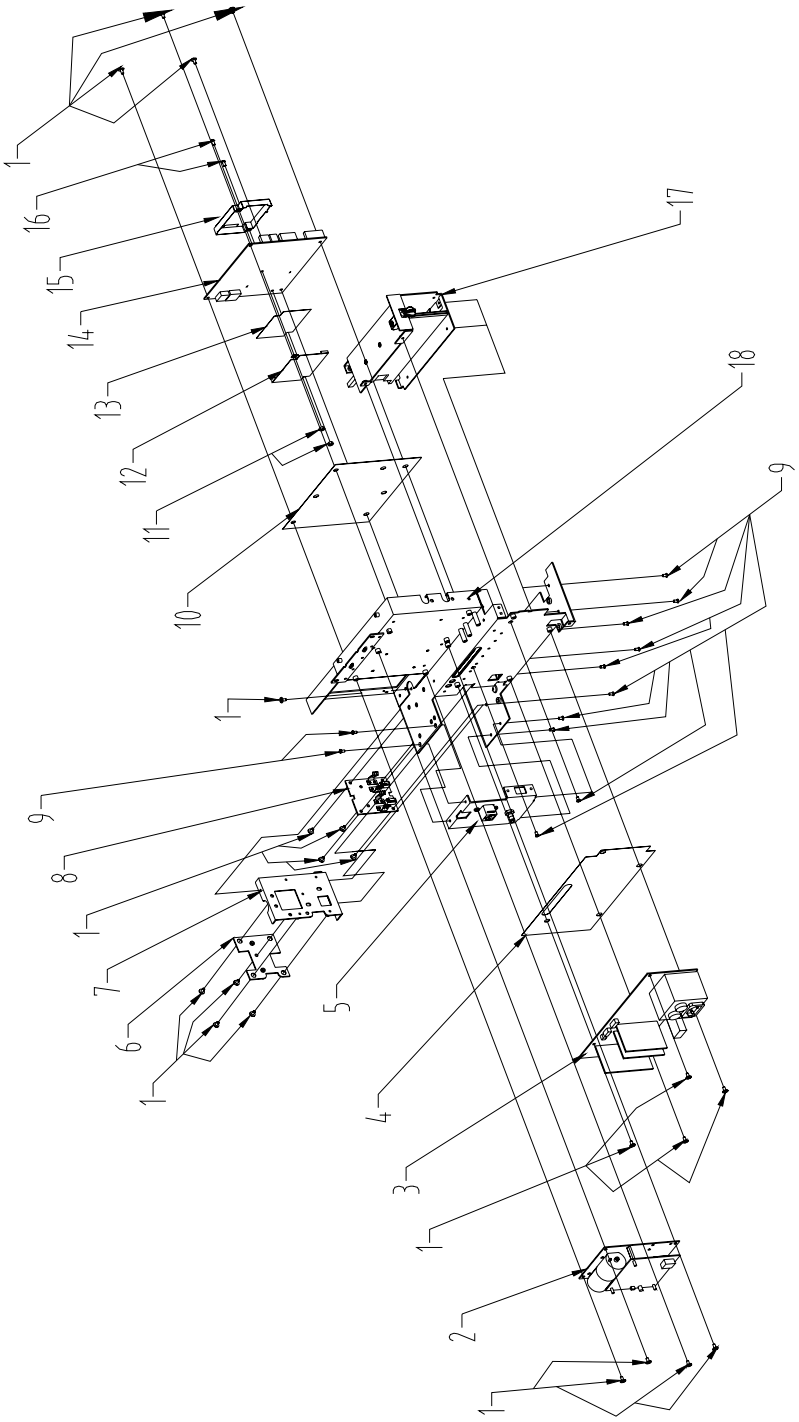


Figure 4-3 MEC-1000 bracket assembly

1	M04-004012---	Cross phoned screw with washer M3x6	21		
2	8100-30-14117	NIBP Pump assembly	1		
3	9200-30-10489	Power board	1		
4	9200-20-10515	Isolation panel of Power board	1		
5	9303-30-21803	Socket panel Assembly	1		
6	9200-20-10689	Recorder Adjust Board	1		
7	9200-20-10485	Printer Install Board	1		
8	9000-30-05178	Battery backboard	1		
9	M04-005005---	Screw GB819-85 M3x6	12		
10	9200-20-10545	Isolation panel for main board	1		
11	M04-000301---	NUT GB617II-M3	2		
12	5000-20-14634	Bottom shield of Main board	1		
13	5000-20-14632	Isolation panel for the shield	1		
14	5100-30-26870	Main Board(ALL in one Board)	1		
15	5000-20-14633	Top shield of Main Board	1		
16	M04-002505---	Screw GB818-86 M3x6	2		
17	9200-30-10492	Battery Box Assembly	1		
18	M1K1-21-22358	Bracket	1		
SN	Standard Code	Name & SPEC.	QTY.	Material	Remarks

4.1.4 Parameter Socket Assembly

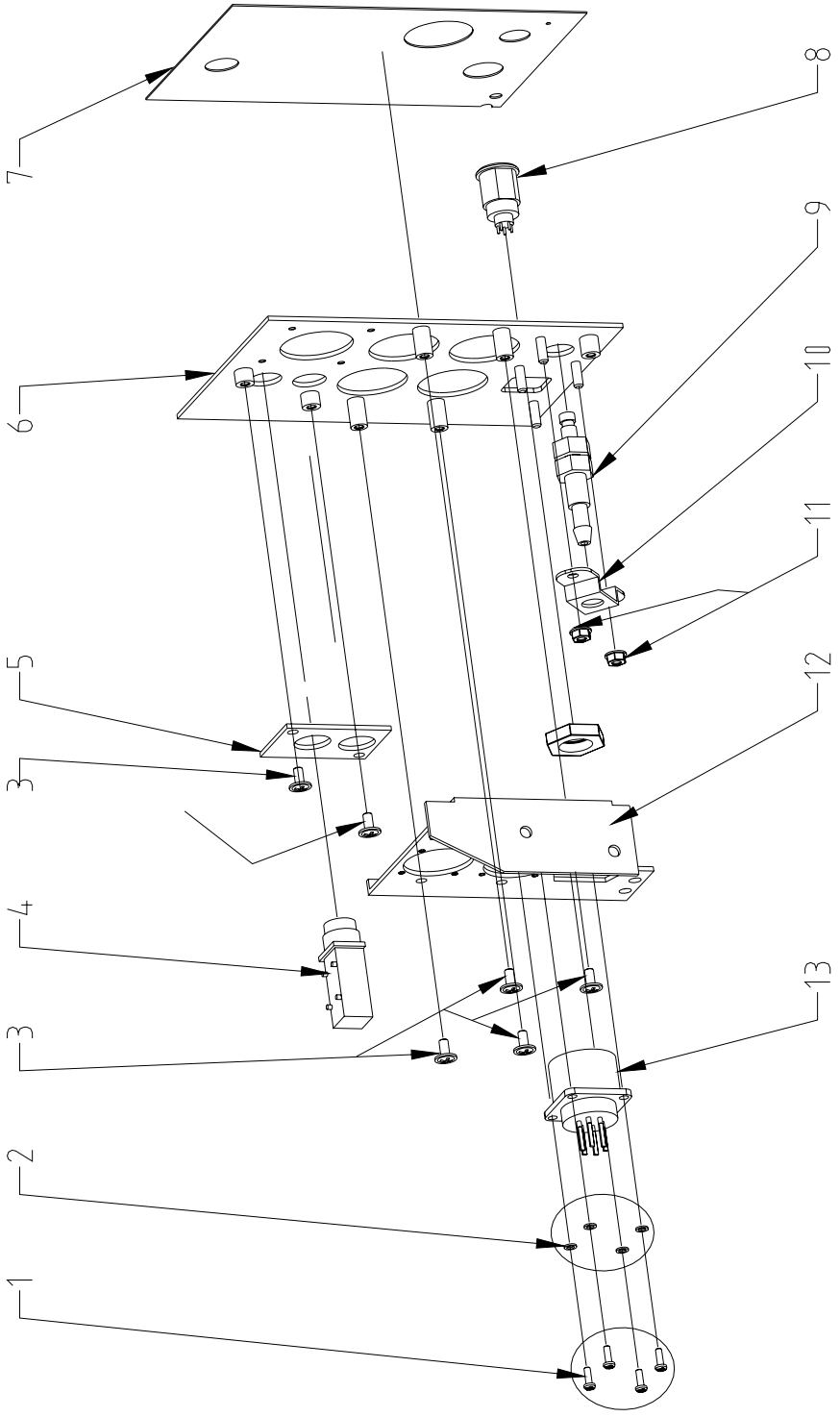


Figure 4-4 Parameter socket assembly

1	M04-002405---	Screw GB818-86 M2x6	4		
2	M04-000102---	Washer GB97.2 2	4		
3	M04-004012---	Cross phoned screw with washer M3x6	6		
4	9303-20-21814	Single TEMP signal Cable	1		
5	9000-20-05204	Washer of TEMP probe	1		
6	9200-20-10510	Front Board of the probe Socket	1		
7	9303-20-21800	Panel of the parameter Socket	1		
8	9303-20-21813	SPO2 SIGNAL CABLE	1		
9	509B-10-06191	Connector 20SFTS 04MxN	1		
10	9200-20-05205	Fixing board for the NIBP Module	1		
11	M04-011002---	M3 Nut	2		
12	9200-20-10491	Back board of the probe socket	1		
13	9303-21-21812	ECG signal Cable	1		
SN	Standard Code	Name & SPEC.	QTY.	Material	Remarks

4.1.5 Rear Panel Assembly

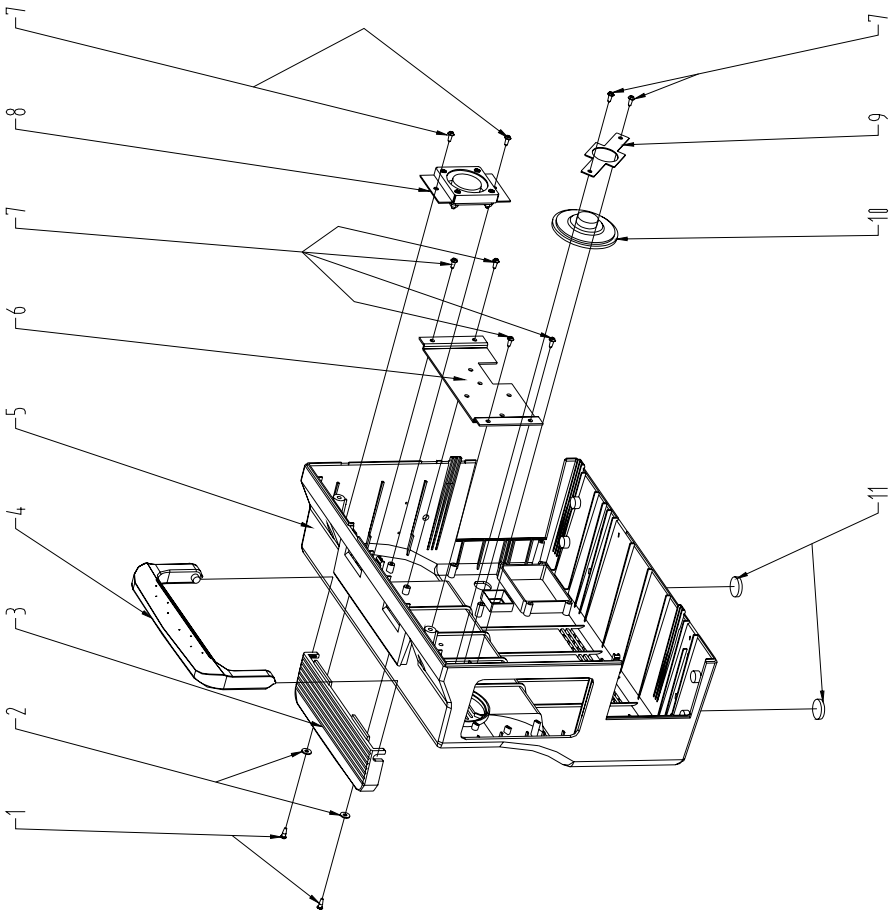


Figure 4-5 Rear panel assembly

1	M04-000305---	Screw M3x12	2		
2	M04-000802---	Washer GB97.2 3	2		
3	LMB9-20-09836	Cover board	1		
4	9300-20-13822	Handle B	1		
5	900E-20-04855	Rear panel	1		
6	9200-20-10622	Install board	1		
7	M04-003105---	Screw GB845-85 M3x6	8		
8	9200-30-10522	FAN assembly	1		
9	9200-20-10620	Press panel of Speaker	1		
10	9200-21-10633	2.25” Speaker with Cable	1		
11	9200-20-10511	Rubber foot 1	1		
SN	Standard Code	Name & SPEC.	QTY.	Material	Remarks

4.2 Use of Battery

4.2.1 Assembly/disassembly

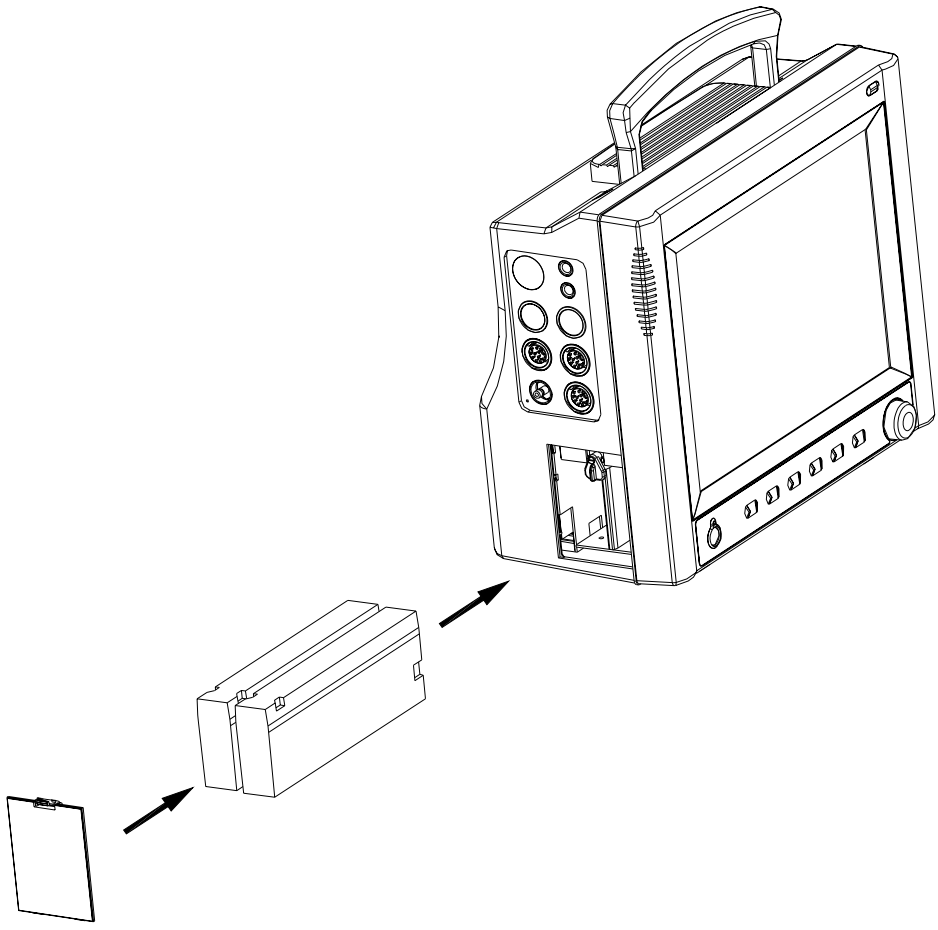


Figure 4-6 Assembly/disassembly of battery

4.2.2 Precautions

(1) Battery specification: Lead-Acid 12V rechargeable battery
(2) Charging time: 6 hours
(3) Discharging time: if the monitor works to measure ECG/RESP/TEMP, SPO2,and NIBP parameters and NIBP is in the mode of one measurement per five minutes, a battery with full capacity can power the monitor continuously for 50 minutes. Five minutes before the battery runs out of its capacity, the monitor will give audio and visual prompt.
(4) To extend the lifespan o the battery, it is recommended to use it at least once monthly. Besides, the battery shall be charged after its capacity is completely exhausted.

4.3 Part list

Part List of MEC-1000

Material No.	Name
0010-20-11954	SPO2 plug
0010-20-11950	ECG plug
1000-21-00122	Grounding wire of machine enclosure
8000-20-10221	Plug of grounding cable
509B-10-05996	3-core power cord (plug LK-C02)
509B-30-06259	External NIBP hose (CE)
509B-30-08845	Finished adult cuff (OEM CE)
630C-20-08481	Adult NIBP cuff CM1203-1
512A-30-90106	Finger SpO2 sensor (OEM)
8000-21-10141	Power cord of DC/DC converter
8000-21-10276	Connecting wire of TR60C recorder of main control board
TR6C-30-16654	TR60-C recorder
5000-20-14633	Upper shielding cover of main board
5000-20-14634	Lower shielding cover of main board
5000-30-14630	Integrated parameter main control board
9200-30-14083	Main bracket
9000-20-05185	Battery Door
9200-30-10489	Power board
8100-30-14117	NIBP pump assembly
8100-30-14119	Backlight board assembly
9303-30-21803	Parameter socket assembly

M05-100R29---	CR2032 button battery 3V lithium
9300-30-13793 or M1K1-30-22355	Au TFT screen assembly or LG TFT screen assembly
0010-10-12096	INVERTOR
M1K1-30-22368	Front panel assembly
9200-21-10633	Speaker
900E-20-04855	Rear panel
9000-10-07294	Accumulator
9210-30-30152	Network board

Chapter 5 Tests

5.1 Test Procedure

5.1.1 Connection and Inspection

Connect the simulator, power supply and fixture onto MEC-1000 monitor; turn on the power. TFT shall display startup picture and then the system screen.

5.1.2 Inspecting Key Functions

Press every key on the keypad. The system shall execute the corresponding function as instructed in the operation manual. The encoder shall execute the corresponding as well.

5.1.3 ECG/RESP test

TFT shall display standard ECG wave. The error between the heart rate and the setup value of simulator shall not exceed ±1; that is 60±1. RESP wave shall be smooth and uniform. RESP Rate shall be 20±1.

① Sequentially select all leads include Cal, four gain options and AUTO, FILTER and NON-FILTER modes; the monitor shall give correct display. The 50/60HZ interference shall be removed;

② Consistency shall exist for heart beat sound, flashing of heart symbol and appearance of R wave in the above mentioned situations;

③ Gain has correct influence on HR calculation and judgment of “Weak ECG Signal”;

④ Verification of measuring range and accuracy: ECG signal amplitude of simulator is 1mV. Heart rate is respectively 60, 120, 200. Respectively connect lead I, II, and III, the results shall satisfy 59~61, 119~121, 198~202;

⑤ PACE pulse test: set the simulator to PACE mode, change PACE amplitude to ±8～700mv and pulse width to 0.1ms～2ms, the system shall distinguish PACE signal and display LEAD OFF prompt correctly;

⑥ RESP measurement: set the baseline impedance to 1K and RESP resistance respectively to 0.5Ω and 3Ω, RESP Rate respectively to 30 and 120, the system shall measure the RESP Rate to be 29~31 and 118～122;

⑦ PVE test: set the simulator to PVC mode and set the appearing times as well, the system shall detect the corresponding PVCS;

⑧ On the simulator, set RESP Rate to 40, base impedance to 2KΩ, and RESP wave to 3:1; set APNEA alarm to ON and adjust RESP resistance to 0Ω, the system shall give different alarms corresponding to different APNEA time;

5.1.4 TEMP Test

① YSI probe

Select YSI TEMP probe in the factory menu; select YSI TEMP probe in the fixture of TEMP test; simulate resistance of 1.355K. The display for TEMP shall be 37±0.1℃ ;

② CY-F1 probe

Select CY-F1 TEMP probe in the factory menu, select CF-Y1 TEMP probe in the fixture of TEMP test; simulate resistance of 6.018K. The display for TEMP shall be 37±0.1℃.

5.1.5 NIBP Test

Connect NIBP simulator, adult cuff and accessories; connect CUFF connector on the module and turn it clockwise to tighten it.

1. After the simulator passes self-test, press “ENT” to enter ADULT NIBP mode. Set the blood pressure to the grade of 255/195/215 mmHg, press SHIFT+15; set heart rate to 80BPM. Also set MEC-1000 to ADULT mode. Press “START” key, the system will give calculating result about 30 seconds later. The results shall be respectively 270±8mmHg, 210±8mmHg and 230±8mmHg;
2. Press “ESC” and “↓” keys on the simulator to enter NEONATE mode. Set the blood pressure to the grade of 120/80/90 mmHg and heart rate to 120BPM. Also set MEC-1000 to PEDIATRIC mode. Press “START” key, the system will give calculating result about 30 seconds later. The results shall be respectively 120±8mmHg, 80±8mmHg and 90±8mmHg;
3. Press “ESC” and “↓” keys on the simulator to enter NEONATE mode. Set the blood pressure to the grade of 60/30/40, select SHIFT to be -20, set heart rate to 120BPM. Use neonate cuff to replace simulator accessory. Press “START” key, the system will give calculating result about 30 seconds later. The results shall be respectively 40±8mmHg, 10±8mmHg and 20±8mmHg.

5.1.6 SpO2 Test

Set HR FROM of MEC-1000 to PLETH. Put finger into SpO2 sensor. The system shall display pulse rate and SpO2 value correctly. The SpO2 measured result of normal human body shall be above 97%.

5.1.7 Recorder Printing Test

1. Print ECG wave, the recorder shall print normally. The output shall be clear, consistent. Create faults like NO PAPER, the system shall give corresponding alarm prompt. The recorder shall work normally after the fault is removed;
2. Execute alarm printing of every parameter. Set Alarm Record switch of every parameter to ON, set up different alarm limits. The system shall execute parameter alarm printing operation once there is parameter alarm.

5.1.8 Power Supply Management

Connect external AC source, the CHARGE indicator on the front panel shall light on. Disconnect the AC source, the CHARGE indicator shall light off. After the monitor is turned on but device for testing battery is not installed, “x” symbol shall appear on the box indicating the battery capacity. Whether the battery is installed or not does not affect the normal function of the monitor. The system will give corresponding alarm once the battery capacity is about to be used up.

5.1.9 Clock Check

When inspecting the whole monitor, check if the clock goes correctly. Then set the clock to the current time.

5.1.10 Set Up the DEFAULT Value When Start Loading Software

Execute the operations indicated in the SYSTEM MENU, such as patient information management, history recall and system setup. The system shall respond correctly and normally. The running of the function shall have no obvious error. Each function complies with corresponding requirement.

5.2 NIBP Calibrating Method

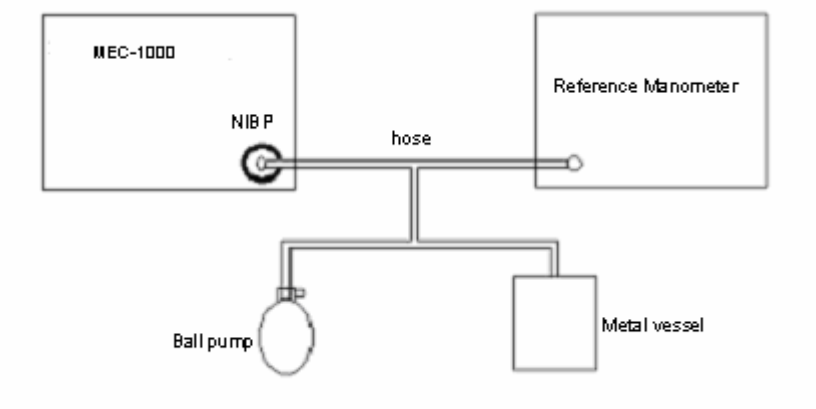


Figure 5-1 Method to calibrate NIBP static pressure

Method: increase pressure gradually in the increment of 50mmHg(6.kPa). The maximum error between any pressure point in the NIBP measurement range of monitor and the value of pressure calibrator shall not exceed ±3mmHg(±0.4kPa). Then decrease pressure gradually. The maximum error between any pressure point in the NIBP measurement range of monitor and the value of pressure calibrator shall not exceed ±3mmHg(±0.4kPa).

5.3 Safety tests

Testing device: BIO-TEK®601PRO safety analyzer

Applied standard: IEC60601-1

Inspection items and methods

5.3.1 Protective Earth Resistance Test

5.3.1.1 Connection

Plug the supply connector of the Monitor Under Test into the 601PRO front panel outlet; Performing the test as instructed in the Operator's Manual of 601PRO. (Set testing current to 25A).

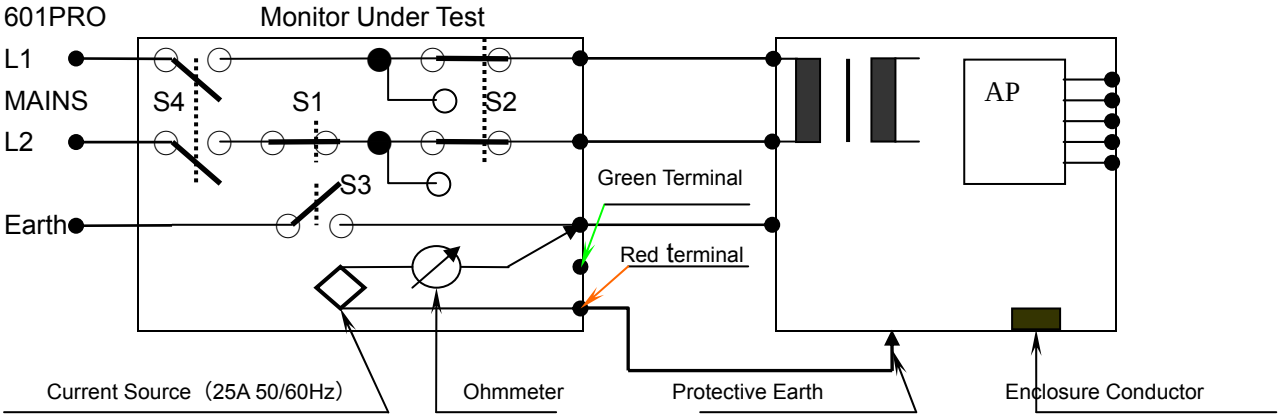
Test of item a: use the Red Testing Lead (accessory of 601PRO) to connect the Red Terminal of 601PRO and Protective Earth Terminal or an accessible metal part of the Monitor Under Test;

Test of item b: use the Red Testing Lead to connect the Red Terminal and the Protective Earth Terminal of the Monitor Under Test; use the Black Testing Lead (accessory of 601PRO) to connect the Green Terminal and any accessible conductor. Test principle is as shown in figure 5-2.

Testing results must comply with:

a The resistance between the Earth Terminal of the power supply cord of the Monitor Under Test and the Protective Earth or any accessible conductor of the enclosure must be less than 0.2Ω;

b. The resistance between the Protective Earth of the Monitor Under Test and any accessible conductor of the enclosure must be less than 0.1Ω.



Note: switches S1 and S2 are not used; S3 and S4 are opened.

Figure 5-2 Protective Earth Resistance Test

5.3.2 Earth Leakage Current Test

5.3.2.1 Connection:

Plug the supply connector of the Monitor Under Test into the 601PRO front panel outlet; turn on the power; safely connect the AP of the Monitor Under Test to the AP Terminal of 601PRO. Test as instructed in the Operator's Manual of 601PRO. Test principle is as shown in figure 5-3.

5.3.2.2 Normal polarity or Reversed polarity:

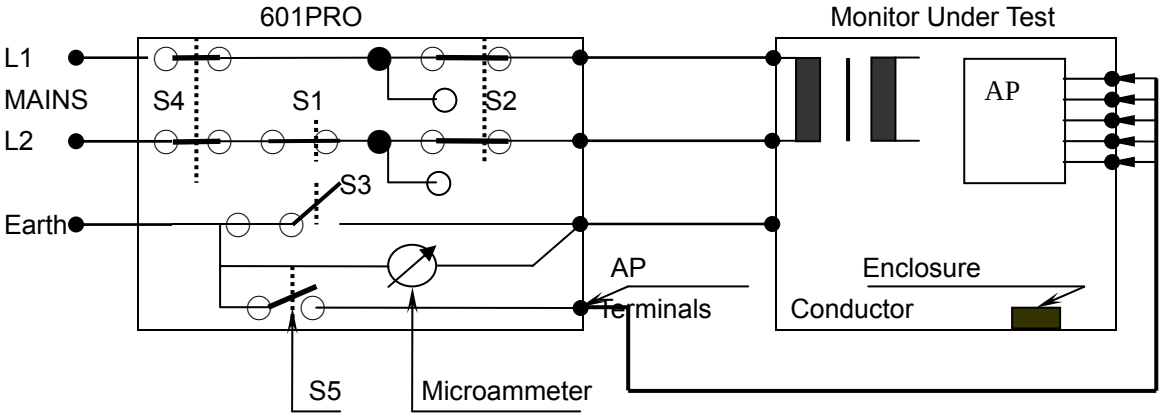
a: Earth open

b: Earth open and null line L2 open

Test results must comply with:

a: Earth open, the leakage current is less than 500μA;

b: Earth open and null line L2 open, leakage current is less than 1000μA.



Note: Switches S1, S2 and S5 are variable, S3 is opened, S4 is closed.

Figure 5-3 Earth Leakage Current Test

5.3.3 Enclosure Leakage Current Test

5.3.3.1 Connection:

Plug the supply connector of the Monitor Under Test into the 601PRO front panel outlet; turn on the power; use the Red Lead to connect the Red Terminal of 601PRO and any accessible conductor of the enclosure of the Monitor Under Test; safely connect the AP of the Monitor Under Test and the AP Terminal of 601PRO. Test as instructed in the operator's manual of 601PRO. Test principle is as shown in figure 5-4.

5.3.3.2 Normal polarity or Reversed polarity:

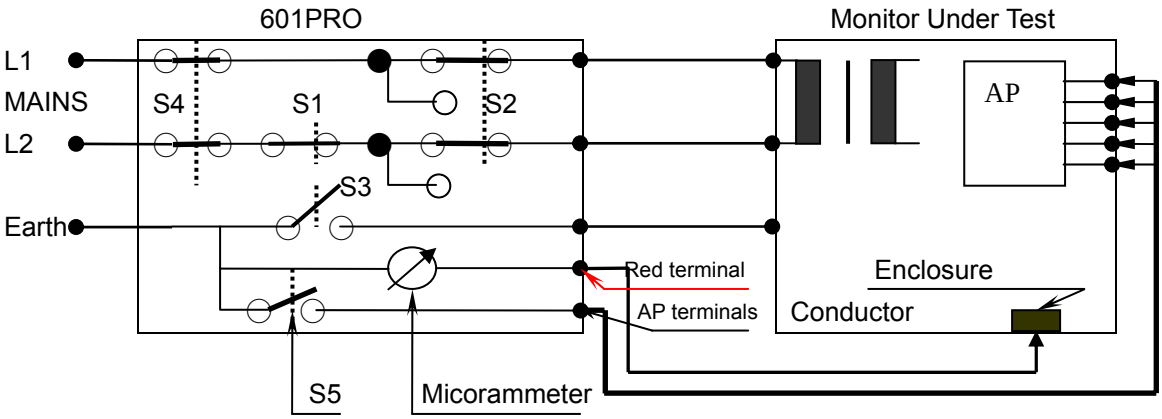
a: Normal condition

b: Single fault condition (Earth open or null line L2 open)

Test results must comply with:

a: In normal condition, the leakage current is less than 100μA；

b: In single fault condition (Earth open or null line L2 open),the leakage current is less than 500 μA.



Note: Switches S1, S2, S3 and S5 are variable, S4 is closed.

Figure 5-4 Enclosure Leakage Current Test

5.3.4 Patient Leakage Current Test

5.3.4.1 Connection:

Plug the supply connector of the Monitor Under Test into the 601PRO front panel outlet; turn on the power; safely connect the AP of the Monitor Under Test to the AP Terminal of 601PRO; test as instructed in the Operator's Manual of 601PRO. Test principle is as shown in figure 5-5.

5.3.4.2 Normal polarity or reversed polarity:

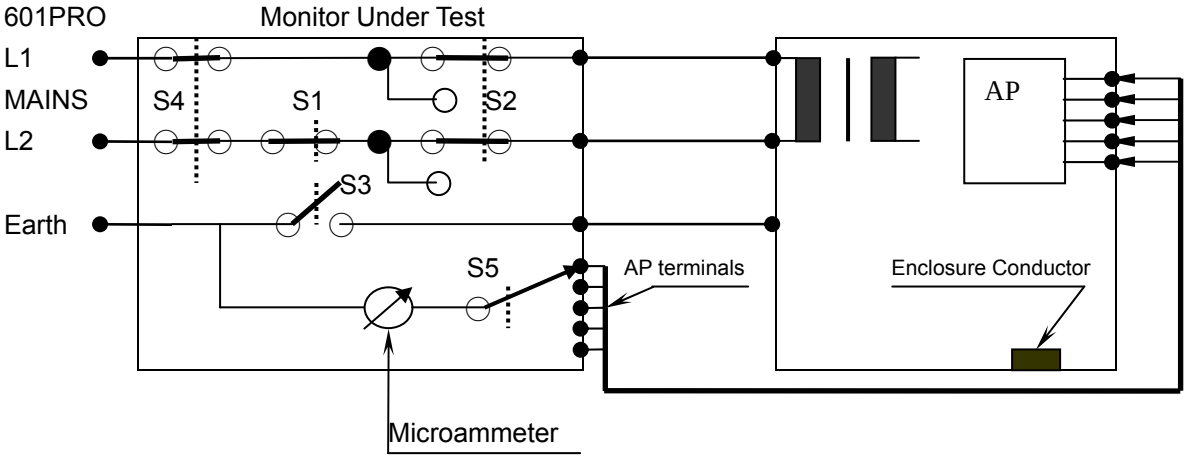
a: Normal condition

b: Single fault condition (Earth open or null line L2 open)

Test results must comply with:

a: In normal condition, the leakage current or DC leakage current is less than 10 μA;

b: In single fault condition (Earth open or null line L2 open),the leakage current or DC leakage current is less than 50 μA.



Note: Switches S1, S2, S3 and S5 are variable, S4 is closed.

Figure 5-5 Patient Leakage Current Test

Chapter 6 Maintenance and Cleaning

6.1 System Checks

6.1.1 Checks Before Using MEC-1000

1. Check if there is any mechanical damage；
2. Check if all the outer cables, inserted modules and accessories are in good condition；
3. Check if all the monitoring functions of the monitor can work normally so as to make sure that the monitor is in good condition.

If you find any damage on the monitor, stop using the monitor on patient, and contact the biomedical engineer of the hospital or Mindray Customer Service Department immediately.

6.1.2 Routine Check

The overall check of the monitor, including the functional safety check, must be performed by qualified personnel once every 6 to 12 month or each time after fix up. All checks that need to open the monitor enclosure must be performed by qualified service personnel.

⚠ **Warning** ⚠

If the hospital or agency that is responding to using the monitor does not follow a satisfactory maintenance schedule, the monitor may become invalid, and the human health may be endangered.

6.2 General Cleaning

⚠ **Warning** ⚠

Turn off the power and disconnect the line power before cleaning the monitor or the sensor/probe.

The MEC-1000 Multi-Parameter Patient Monitor must be kept dust-free.

It is recommended that you should clean the outside surface of the monitor enclosure and the display screen regularly. Only use non-caustic detergents such as soap and water to clean the monitor enclosure.

⚠ **Caution** ⚠

Pay special attention to avoid damaging MEC-1000 monitor:

① Avoid using ammonia-based or acetone-based cleaners such as acetone.

② Most cleaning agents must be diluted before use. Dilute the cleaning agent as per

the manufacturer's direction.

③ Do not use the grinding material, such as steel wool etc.

④ Do not let the cleaning agent enter the monitor. Do not immerse any part of the system into liquid.

⑤ Do not leave the cleaning agents at any part of the equipment.

6.3 Cleaning Agents

Use any of the solutions listed below as the cleaning agent.

①! Diluted Sodium Hyoichlo (Bleaching agent)

②! Diluted Formaldehyde 35% -- 37%

③! Hydrogen Peroxide 3%

④! Alcohol

⑤! Isopropanol

6.4 Sterilization

To avoid extended damage to the equipment, sterilization is only recommended when stipulated as necessary in the Hospital Maintenance Schedule. Sterilization facilities must be cleaned first.

Recommended sterilization materials: Ethylate, and Acetaldehyde.

Appropriate sterilization materials for ECG lead and blood pressure cuff are introduced in relevant chapters of MEC-1000 operation manual.

6.5 Disinfection

To avoid extended damage to the equipment, disinfection is only recommended when stipulated as necessary in the Hospital Maintenance Schedule. Disinfection facilities should be cleaned first.

Appropriate disinfection materials for ECG lead, SpO_2 sensor, blood pressure cuff and TEMP probe are introduced in relevant chapters of MEC-1000 operation manual.

Chapter 7 Troubleshooting

7.1 Back display with white or blurring screen

1) Check if TFT connecting wire is well contacted；
2) If changing connecting wire cannot solve the problem, replace the TFT screen;
3) If fault still exists, replace the main control board.

7.2 Encoder fault

1) If other functions of the keypad run correctly (indicator, alarm light and key), go to the second step; otherwise, replace the keypad;
2) Check if the bonding pad of the encoder is short-circuit connected or abnormal open circuit;
3) Replace the encoder.

7.3 No alarm sound

1) Check if the sound is switched off in the software setups;
2) Replace the speaker;
3) Replace the keypad.

7.4 Can not print

1) Check if the software has alarm related to recorder; if yes, remove the corresponding alarm;
2) Check if the indicator of the recorder is lighted on;
3) If not, check the connecting wire of signal input of the recorder;
4) Check if the recorder module is set to ON in the MAINTAIN menu;
5) Check the connecting wire of the power input of the recorder (including power board of the recorder);
6) Replace the recorder.

7.5 Abnormal paper feeding

1) Check if foreign objects are attached to the paper bail of the recorder;
2) Check if foreign objects are attached to the gears of the thermal head of the recorder;
3) Check if the power voltage of the recorder is >7.8V.

System Alarm Prompt

PROMPT	CAUSE	MEASURE
"XX TOO HIGH"	XX value exceeds the higher alarm limit.	Check if the alarm limits are appropriate and the current situation of the patient.
"XX TOO LOW"	XX value is below the lower alarm limit.	
XX represents the value of parameter such as HR, ST, RR, SpO_2, NIBP, etc in the system.		
"ECG WEAK SIGNAL"	The ECG signal of the patient is too small so that the system can not perform ECG analysis.	Check if the electrodes and lead wires are connected correctly and the current situation of the patient.
“NO PULSE”	The pulse signal of the patient is too small so that the system can not perform pulse analysis.	Check the connection of the sensor and the current situation of the patient.
"RESP APNEA"	The respiration signal of the patient is too small so that the system cannot perform RESP analysis.	Check the connection of the linking wire and the current situation of the patient.
"ASYSTOLE"	Patient suffers from Arr. Of ASYSTOLE.	Check the current situation of the patient. Check the connection of the electrodes and lead wires.
"VFIB/VTAC"	Patient suffers from Arr. of VFIB/VTAC.	Check the current situation of the patient. Check the connection of the electrodes and lead wires.
"BIGEMINY"	Patient suffers from Arr. Of BIGEMINY.	Check the current situation of the patient. Check the connection of the electrodes and lead wires.
"TRIGEMINY"	Patient suffers from Arr. of TRIGEMINY.	Check the current situation of the patient. Check the connection of the electrodes and lead wires.
"R ON T"	Patient suffers from Arr. of R ON T.	Check the current situation of the patient. Check the connection of the electrodes and lead wires.
"PVC"	Patient suffers from Arr. of PVC.	Check the current situation of the patient. Check the connection of the electrodes and lead wires.
"COUPLET"	Patient suffers from Arr. of COUPLET.	Check the current situation of the patient. Check the connection of the electrodes and lead wires.
"TACHY"	Patient suffers from TACHY.	Check the current situation of the

		patient. Check the connection of the electrodes and lead wires.
" BRADY"	Patient suffers from BRADY.	Check the current situation of the patient. Check the connection of the electrodes and lead wires.
"VT>2"	Patient suffers from Arr. of VT>2.	Check the current situation of the patient. Check the connection of the electrodes and lead wires.
“MISSED BEATS”	Patient suffers from Arr. of MISSED BEATS.	Check the current situation of the patient. Check the connection of the electrodes and lead wires.
"PNP"	The pacemaker is not paced.	Check the connection of the pacemaker. Check the connection of electrodes and lead wires. Check the current situation of the patient.
"PNC"	No pacemaker signal is captured.	Check the connection of the pacemaker. Check the connection of electrodes and lead wires. Check the current situation of the patient.
"ECG LEAD OFF"	ECG lead is not connected correctly.	Check the connection of ECG lead wire.
"ECG LL LEAD OFF";	The LL lead wire of ECG is not connected correctly.	Check the connection of LL lead wire.
"ECG LA LEAD OFF";	The LA lead wire of ECG is not connected correctly.	Check the connection of LA lead wire.
"ECG RA LEAD OFF";	The RA lead wire of ECG is not connected correctly.	Check the connection of RA lead wire.
"ECG F LEAD OFF";	The F lead wire of ECG is not connected correctly.	Check the connection of F lead wire.
"ECG L LEAD OFF";	The L lead wire of ECG is not connected correctly.	Check the connection of L lead wire.
"ECG R LEAD OFF";	The R lead wire of ECG is not connected correctly.	Check the connection of R lead wire.
"SPO2 SENSOR OFF"	SPO2 sensor is not connected correctly.	Check the connection of SpO2 sensor.
"SEARCH PULSE"	SPO2 sensor is not connected correctly or the patient arm moves.	Check the connection of SpO2 sensor. Check the current situation of the patient.
"TEMP SENSOR OFF"	TEMP sensor is not	Check the connection of TEMP

	connected correctly.	sensor.
"ECG NOISE"	Rather large interference signals appear in the ECG signals.	Check the connection of ECG lead wire. Check the current situation of the patient. Check if the patient moves a lot.
"XX INIT ERR X"	XX has error X during initialization.	Re-start up the monitor or re-plug in/out the module. If the error still exists, contact the manufacturer.
"XX COMM STOP"	XX cannot communicate with the host.	
"XX COMM ERR"	XX cannot communicate normally with the host.	
XX represents all the parameter modules in the system such as ECG, NIBP, SpO_2, , etc.		
"XX ALM LMT ERR"	The alarm limit of XX parameter is modified by chance.	Contact the manufacturer for repair.
"XX RANGE EXCEEDED"	The measured value of XX parameter has exceeded the measuring range of the system.	Contact the manufacturer for repair.
XX represents the parameter name in the system such as HR, ST, RR, SpO_2, NIBP, etc.		
"REAL CLOCK NEEDSET"	When the system displays 2000-1-1, the system gives this prompt reminding the user that the current system time is not right.	Re-set up the system time. It is better to set up the time just after the start-up and prior to monitoring the patient. After modifying the time, the user had better re-start up the monitor to avoid storing error time.
"REAL CLOCK NOT EXIST"	The system has no cell battery or the battery has run out of the capacity.	Install or replace the rechargeable battery.
"SYSTEM WD FAILURE"	The system has serious error.	Re-start up the system. If the failure still exists, contact the manufacturer.
"SYSTEM SOFTWARE ERR"		
"SYSTEM CMOS FULL"		
"SYSTEM CMOS ERR"		
"SYSTEM EPGA FAILURE"		
"SYSTEM FAILURE2"		
"SYSTEM FAILURE3"		
"SYSTEM FAILURE4"		
"SYSTEM FAILURE5"		
"SYSTEM FAILURE6"		

"SYSTEM FAILURE7"		
"SYSTEM FAILURE8"		
"SYSTEM FAILURE9"		
"SYSTEM FAILURE10"		
"SYSTEM FAILURE11"		
"SYSTEM FAILURE12"		
"KEYBOARD NOT AVAILABLE";	The keys on the keyboard cannot be used.	Check the keys to see whether it is pressed manually or by other object. If the key is not pressed abnormally, contact the manufacturer for repair.
"KEYBOARD COMM ERR";	The keyboard has failure, which cannot be used.	Contact the manufacturer for repair.
"KEBOARD ERROR";		
"KEYBOARD ERR1";		
"KEYBOARD ERR2";		
"5V TOO HIGH"	The power part of the system has failure.	If the prompt appears repeatedly, contact the manufacturer for repair.
"5V TOO LOW"		
"POWER ERR3"		
"POWER ERR4"		
"12V TOO HIGH"		
"12V TOO LOW"		
"POWER ERR7"		
"POWER ERR8"		
"3.3V TOO HIGH"		
"3.3V TOO LOW"		
"RECORDER SELFTEST ERR"	During the selftest, the system fails connecting with the recorder module.	Execute ‘Clear Record Task’ function in the recorder setup menu to re-connect the host and the recorder. If the failure still exists, contact the manufacturer for repair.
"RECORDER VLT HIGH"	The recorder module has voltage failure.	Contact the manufacturer for repair.
"RECORDER VLT LOW"		
"RECORDER HEAD HOT"	The continuous recording time may be too long.	After the recorder becomes cool, use the recorder for output again. If the failure still exists, contact the manufacturer for repair.
"REC HEAD IN WRONG POSITION"	The handle for pressing the paper is not pressed down.	Press down the recorder handle for pressing the paper.

"RECORDER OUT OF PAPER"	No paper is in the recorder.	Place the paper into the recorder.
"RECORDER PAPER JAM"	The paper in the recorder is jammed.	Place the recorder correctly and try again.
"RECORDER COMM ERR"	The communication of the recorder is abnormal.	In the recorder setup menu, execute the function of clearing record task. The function can make the host and the recorder connect again. If the failure still exists, contact the manufacturer for repair.
"RECORDER S. COMM ERR"		
"RECORDER PAPER W.P."	The paper roll of the recorder is not placed in the correction position.	Place the paper roll in the correct position.
"REC NOT AVAILABLE"	Cannot communicate with the recorder.	In the recorder setup menu, execute the function of clearing record task. The function can make the host and the recorder connect again. If the failure still exists, contact the manufacturer for repair.
"NIBP INIT ERR"	NIBP initialization error	Execute the reset program in the NIBP menu. If the failure still exists, contact the manufacturer for repair.
"NIBP SELFTEST ERR"		
"NIBP ILLEGALLY RESET"	During NIBP measurement, illegal reset occurs.	Check the airway of NIBP to see if there are clogs. Then measure again, if the failure still exists, contact the manufacturer for repair.
"NIBP COMM ERR"	The NIBP communication part has problem.	Execute the reset program in the NIBP menu. If the failure still exists, contact the manufacturer for repair.
"LOOSE CUFF"	The NIBP cuff is not connected correctly.	Re-connect the NIBP cuff.
"AIR LEAK"	The NIBP cuff is not connected correctly or there are leaks in the airway.	Check the connection of each part or replace with a new cuff. If the failure still exists, contact the manufacturer for repair.
"AIR PRESSURE ERROR"	Problem happens when measuring the curve. The system cannot perform	Check the connection of each part or replace with a new cuff. If the failure still exists, contact the

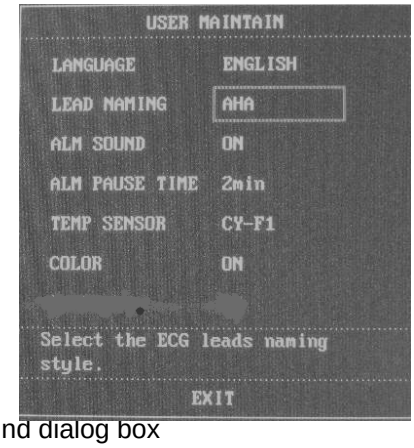
	measurement, analysis or calculation.	manufacturer for repair.
"WEAK SIGNAL"	Problem happens when measuring the curve. The system cannot perform measurement, analysis or calculation.	Check if the setup of patient type is correct. Check the connection of each part or replace with a new cuff. If the failure still exists, contact the manufacturer for repair
"RANGE EXCEEDED"	Problem happens when measuring the curve. The system cannot perform measurement, analysis or calculation.	Check the connection of each part or replace with a new cuff. If the failure still exists, contact the manufacturer for repair.
"EXCESSIVE MOTION"	The patient arm moves.	Check the connection of each part and the patient situation. Measure again, if the failure still exists, contact the manufacturer for repair.
"OVER PRESSURE"	Perhaps folds exist in the airway.	Check for the smoothness in the airway and patient situation. Measure again, if the failure still exists, contact the manufacturer for repair.
"SIGNAL SATURATED"	Problem happens when measuring the curve. The system cannot perform measurement, analysis or calculation.	Check the connection of each part and the patient situation. Measure again, if the failure still exists, contact the manufacturer for repair.
"NIBP TIME OUT"	Problem happens when measuring the curve. The system cannot perform measurement, analysis or calculation.	Check the connection of each part and the patient situation. Measure again, if the failure still exists, contact the manufacturer for repair.
"CUFF TYPE ERR"	Perhaps the used cuff does not fit the setup patient type.	Check if the patient type is set up correctly. Check the connection of each part or replace with a new cuff. If the failure still exists, contact the manufacturer for repair.
"PNEUMATIC LEAK"	NIBP airway has leaks.	Check the connection of each part or replace with a new cuff. If the failure still exists, contact the manufacturer for repair.
"MEASURE FAIL"	Problem happens when measuring the curve. The	Check the connection of each part and the patient situation. Measure

	system cannot perform measurement, analysis or calculation.	again, if the failure still exists, contact the manufacturer for repair.
"NIBP SYSTEM FAILURE"	Problem happens when measuring the curve. The system cannot perform measurement, analysis or calculation.	Check the connection of each part and the patient situation. Measure again, if the failure still exists, contact the manufacturer for repair.

CHAPTER 8 Maintenance Menu

MAINTENANCE MENU

8.1 User Maintain menu



8.1.1 Language Select

Enter USER MAINTAIN menu, then select the right Language from dialog box

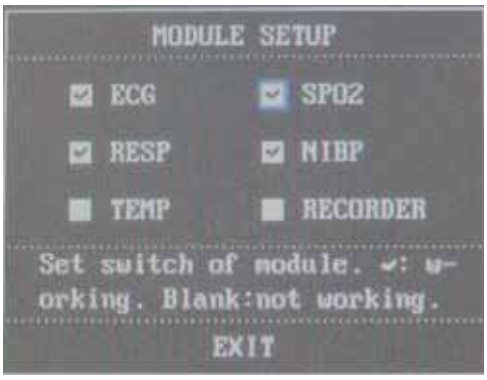
8.1.2 Open/Close alarm sound

Enter USER MAINTAIN menu, select “ON” in alarm sound dialog box to open alarm sound. Select “OFF” in alarm sound dialog box to close alarm sound.

8.1.3 Select TEMP probe type

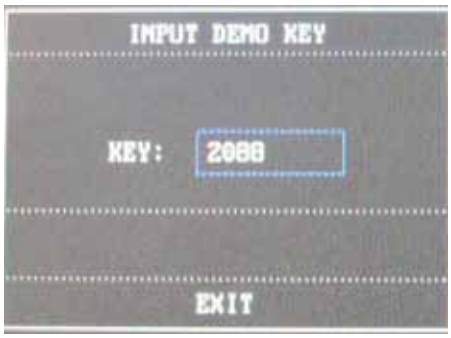
Enter FATORY MAINTAIN menu, then select the right type between CY-F1 type and YSI type.

8.2 Factory Maintain



8.3 Password

1. user key: MINDRAY
2. Factory key: 332888
3. DEMO key: 2088



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